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| APPLICATION NO.  | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO.    |
|--|-------------|----------------------|---------------------|---------------------|
| 10/809,384   | 03/26/2004  | Sung-Fei Wang        | WANG3232/EM         | 7610                |
| 23364  | 7590        | 03/14/2005           | EXAMINER            |                     |
| BACON & THOMAS, PLLC<br>625 SLATERS LANE<br>FOURTH FLOOR<br>ALEXANDRIA, VA 22314 |             |                      |                     | SANDVIK, BENJAMIN P |
|  |             |                      | ART UNIT            | PAPER NUMBER        |
|  |             |                      | 2826                |                     |

DATE MAILED: 03/14/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Axe

|                              |                            |                  |
|------------------------------|----------------------------|------------------|
| <b>Office Action Summary</b> | Application No.            | Applicant(s)     |
|                              | 10/809,384                 | WANG, SUNG-FEI   |
|                              | Examiner<br>Ben P. Sandvik | Art Unit<br>2826 |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) Responsive to communication(s) filed on 3/26/2004.
- 2a) This action is **FINAL**.                    2b) This action is non-final.
- 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) Claim(s) 1-18 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) Claim(s) \_\_\_\_\_ is/are allowed.
- 6) Claim(s) 1-18 is/are rejected.
- 7) Claim(s) 17 is/are objected to.
- 8) Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) The specification is objected to by the Examiner.
- 10) The drawing(s) filed on \_\_\_\_\_ is/are: a) accepted or b) objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).  
11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
  - a) All    b) Some \* c) None of:
    1. Certified copies of the priority documents have been received.
    2. Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
    3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)                     |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                    | Paper No(s)/Mail Date. _____.   |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____. | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
|   | 6) <input type="checkbox"/> Other: _____.                                   |

## DETAILED ACTION

### *Drawings*

The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the "ring-like bump" as disclosed in claim 17 must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

1. Claims 1-4 and 12-13 are rejected under 35 U.S.C. 102(b) as being anticipated by Nakamura(U.S. Patent #6225702).

i. With respect to **claim 1**, Nakamura teaches the claimed flip-chip package (Fig. 3) comprising the claimed substrate (Fig. 3, #5) wherein the substrate has a first central area (Fig 4, 3a) and a first peripheral area (Fig. 4, 3b and 3c), the claimed chip (Fig.3, #1) wherein the active surface has a second central area (Fig 4, 3a) and a second peripheral area (Fig. 4, 3b and 3c), and the claimed plurality of conductive bumps interposed between the first and second peripheral areas (Fig. 4, 3b and 3c).

Nakamura also teaches a central area comprised of power supply bumps (Col 3 Ln 54), which also meet the limitation of reinforced bumps connecting the first and second central areas.

ii. With respect to **claim 2**, Nakamura further teaches that the first central area is rectangular (Fig. 4, 3a).

iii. With respect to **claim 3**, Nakamura further teaches that the first peripheral area is ring-like (Fig. 4).

- iv. With respect to **claim 4**, Nakamura further teaches that there is a first intermediate area of indiscriminate size between the first central and first peripheral areas, and the first intermediate area is ring-like (Fig. 4).
- v. With respect to **claim 12**, Nakamura further teaches that the reinforced bumps comprise metal bumps (Col 3 Ln 44).
- vi. With respect to **claim 13**, Nakamura further teaches that the reinforced bumps comprise metal bumps (Col 3 Ln 44) and it is inherent that metal is thermally conducting, thus one reinforced bump is a thermally conductive bump.

#### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

**Claim 5** is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The claim disclosed could not be read as a distinct limitation. One way of reading claim 5 suggests that it is being claimed that there are multiple rings of conductive and reinforced bumps; another way of reading claim 5 suggests that the electrically conductive bumps are located in the first central area and the reinforced bumps are located in the first peripheral area. Hence, the subject matter is not particularly pointed and distinctly claimed.

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 6-9 and 14-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nakamura in view of Barrow (U.S. #5894410).

vii. With respect to **claim 6**, Nakamura teaches all of the limitations of claim 4, but does not teach that the first intermediate area has a width at least larger than the double of the width of the electrically conductive bump. Barrow teaches a solder bump configuration wherein the first intermediate area has a width at least larger than the double of a width of the electrically conductive bump (Fig. 4). It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the width of the first intermediate area as taught by Barrow to reduce mechanical stress on the electrically conductive bumps.

viii. With respect to **claim 7**, Nakamura teaches all of the limitations of claim 5, but does not teach a distance between the innermost electrically conductive bump and the outermost reinforced bump that is at least larger than the double of a width of the reinforced bump. Barrow teaches a distance as described above being at least larger than the double of a width of the reinforced bump (Fig. 4). It would have been obvious to one

of ordinary skill in the art at the time the invention was made to modify the distance between the innermost electrically conductive bump and the outermost reinforced bump as taught by Barrow to reduce mechanical stress on the electrically conductive bumps.

ix. With respect to **claim 8**, Nakamura teaches all of the limitations of claim 4, plus spherical conductive bumps (Col 2 Ln 17). Nakamura does not teach a first intermediate area with a width at least larger than a diameter of a conductive bump. Barrow teaches a width as described above being at least larger than a diameter of a conductive bump (Fig. 4). It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the width of the first intermediate area as taught by Barrow to reduce mechanical stress on the electrically conductive bumps.

x. With respect to **claim 9**, Nakamura teaches all of the limitations of claim 5, plus spherical conductive bumps (Col 2 Ln 17). Nakamura does not teach a distance between the innermost electrically conductive bump and the outermost reinforced bump that is at least larger than the double of a diameter of the reinforced bump. Barrow teaches a distance as described above being at least larger than the double of a diameter of a reinforced bump (Fig. 4). It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the distance between the innermost electrically conductive bump and the outermost

reinforced bump as taught by Barrow to reduce mechanical stress on the electrically conductive bumps.

xi. With respect to **claim 14**, Nakamura teaches all of the limitations of claim 1, but does not teach a solder ball formed on the lower surface of the substance. Barrow teaches a solder ball formed on the lower surface of the substrate (Col 1 Ln 57-59). It would have been obvious to one of ordinary skill in the art at the time the invention was made to place solder balls on the lower surface of the substrate in order to facilitate connection to a printed circuit board.

xii. With respect to **claim 15**, Nakamura teaches all of the limitations of claim 4 and a sphere, but does not teach the first intermediate area with a width substantially equal to the double of a diameter of the electrically conductive bump. Barrow teaches a width as described above being at least larger than a diameter of a conductive bump (Fig. 4). It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the width of the first intermediate area to substantially equal to double the diameter of a conductive bump based on the teachings of Barrow in order to reduce mechanical stress on the electrically conductive bumps.

xiii. With respect to **claim 16**, Nakamura teaches all of the limitations of claim 5 and a sphere, but does not teach the distance between the innermost electrically conductive bump and the outermost reinforced

bump being substantially equal to the double of the diameter of a reinforced bump. Barrow teaches a distance as described above being at least larger than the double of a diameter of a reinforced bump (Fig. 4). It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the distance between the innermost electrically conductive bump and the outermost reinforced bump to substantially equal to double the diameter of a reinforced bump based on the teachings of Barrow to reduce mechanical stress on the electrically conductive bumps.

3. Claims 10 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nakamura in view of Caletka et al (U.S. #6104093), hereafter known as Caletka.

xiv. With respect to **claim 10**, Nakamura teaches all of the limitations of claim 1, but does not teach an underfill disposed between the chip and the substrate and covering the electrically conductive bumps. Caletka teaches an underfill as described above (Col 4 Ln 20). It would have been obvious to one of ordinary skill in the art at the time the invention was made to make a flip chip comprising an underfill disposed between the chip and the substrate and covering the electrically conductive bumps as taught by Caletka in order to keep moisture from the conductive bumps and to reinforce the bumps.

xv. With respect to **claim 11**, Nakamura teaches all of the limitations of claim 1, but does not teach an underfill disposed between the chip and the substrate and covering the reinforced bumps. Caletka teaches an underfill as described above (Col 4 Ln 20). It would have been obvious to one of ordinary skill in the art at the time the invention was made to make a flip chip comprising an underfill disposed between the chip and the substrate and covering the reinforced bumps as taught by Caletka in order to keep moisture from the conductive bumps and to reinforce the bumps.

4. Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nakamura, in view of Rostoker (U.S. #5767580).

With respect to **claim 17**, Nakamura teaches all of the limitations of claim 1, but does not teach one of the reinforced bumps being a ring-like bump. Rostoker teaches a ring-like bump (Col 8 Ln 30, Fig. 4a). It would have been obvious to one of ordinary skill in the art at the time the invention was made to make a ring-like reinforcing bump as taught by Rostoker in order to enhance the bonding strength between the chip and the substrate.

5. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nakamura, in view of Farnworth et al (U.S. #6558979), hereafter known as Farnworth.

xvi. With respect to **claim 18**, Nakamura teaches all of the limitations of claim 1, but does not teach reinforced bumps made of epoxy. Farnworth teaches bumps made of epoxy (abstract). It would have been obvious to one of ordinary skill in the art at the time the invention was made to make reinforced bumps out of epoxy (Col 2 Ln 11) in order to reduce the damaging effects of TCE mismatch.

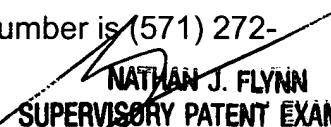
#### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claim 17 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. The “ring-like bump” claimed in 17 is not properly enabled by the specification, hence, it would require undue experimentation by one of ordinary skill in the art to make or use the invention.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ben P. Sandvik whose telephone number is (571) 272-8446. The examiner can normally be reached on Everyday.

  
**NATHAN J. FLYNN**  
**SUPERVISORY PATENT EXAMINER**  
**TECHNOLOGY CENTER 2800**

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nathan Flynn can be reached on (571) 272-8446. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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